THE STUDY ON THE IMPACT OF CONSTANT POWER LOAD TO A DIRECT CURRENT POWER SYSTEM DRIVEN BY PHOTOVOLTAIC, WIND - THYRISTOR RECTIFIER AND LINEAR SOURCES

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Specially dedicated to my beloved parent, brothers and sisters for their love, dedication and sacrifice

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ABSTRACT

The phenomenon of instability is a major concern in DC power system. This phenomenon is contributed by the undesirable interaction between converter source-load as well as the behaviour of the power electronic loads which behave as a constant power load. This phenomenon occurs since each converter has its internal control function to regulate the output voltage. As a consequence, the converter tends to draw a constant power which produces negative incremental input impedance within its bandwidth, in which can lead the instability in the DC power system. The effect of constant power load to a DC power system driven by photovoltaic (PV), combination of wind and thyristor rectifier and also linear sources have been examined in this project. The effects of constant power load (CPL) to a DC power system was extensively reviewed and examined through simulation using MATLAB simulation software. The higher the power level of CPL used, more severe effects on the DC bus system is observed especially when it been driven by the wind energy sources. Simple compensation method using RC parallel passive damping network was proposed and the simulation on a DC power system driven by linear sources shows that the system managed to gain stability under steady state condition.

ABSTRAK

Fenomena ketidakstabilan voltan menjadi satu kebimbangan utama dalam sistem bekalan kuasa arus terus (AT). Gangguan yang tidak diingini ini boleh berlaku disebabkan tindakbalas di antara punca-beban sesebuah penukar dan juga disebabkan perilaku beban elektronik berkuasa malar. Fenomena ini berlaku kerana litar kawalan dalaman litar penukar cuba menetapkan voltan keluarannya. Akibatnya, litar penukar berkecenderungan untuk menghasilkan bekalan berkuasa malar, yang sifat galangan masukkannya adalah negatif menaik di dalam lingkungan jalur lebarnya yang boleh menyebabkan sistem bekalan kuasa arus terus (AT) menjadi tidak stabil. Projek ini mengkaji kesan penggunaan beban berkuasa malar terhadap sistem bekalan AT. Sumber kuasa yang digunakan ialah voltan photo (PV), kombinasi angin dan penerus thyristor dan juga sumber bekalan kuasa linear. Kesan penggunaan beban berkuasa malar terhadap sistem bekalan kuasa AT telah dikaji secara mendalam secara literasi dan juga melalui simulasi menggunakan perisian MATLAB. Keputusan yang diperolehi melalui penggunaan beban berkuasa malar sebesar 1000 W menunjukkan bahawa beban berkuasa malar terbukti menyebabkan ketidakstabilan sistem AT yang dipandu oleh tenaga angin, PV (di bawah keadaan fana) dan juga sumber linear. Kesan ketidakstabilan lebih buruk sekiranya sumber tenaga angin digunakan. Juga diperhatikan bahawa semakin tinggi nilai beban berkuasa malar, sistem menjadi lebih tidak stabil. Kaedah penstabilan mudah dengan menggunakan redaman pasif selari RC telah dicadangkan dan pelaksanaan melalui simulasi ke atas sistem bekalan kuasa AT dari sumber linear menunjukkan bahawa sistem berjaya mencapai keadaan stabil.